

**DETAILED SYLLABUS FOR THE POST OF DEMONSTRATOR IN  
ELECTRONICS AND INSTRUMENTATION & DEMONSTRATOR IN  
INSTRUMENT TECHNOLOGY IN TECHNICAL EDUCATION  
DEPARTMENT**

**(CATEGORY NO. 295/2021 & 296/2021)**

**MODULE 1 (15 marks)**

**TRANSDUCERS AND CLASSIFICATION**

Basics of Transducers-

active, passive , analog and digital transducers, mechanical and electrical transducer  
Resistance transducers- linear and rotary potentiometer , strain gauges -types of strain gauges.

Inductance and Magnetic Transducers:

variable inductance transducer-variable reluctance and variable eddy current inductive  
transducer LVDT, Magnetic transducers ,search coils. magneto resistive transducer ,hall effect  
transducer

Photo electric transducers : photoelectric effect , photo emissive cell ,photo Conductive cell, photo  
voltaic cell , photo multiplier tube , solar cells.

Capacitance transducers, Piezoelectric transducers, photoelectric transducers

Radiation Detectors

Ultrasonic transducers, inductive type Proximity sensors , capacitive type proximity sensors , Smart  
sensors and smart transmitters , IC sensors .

**MODULE 2 (15 marks)**

**INDUSTRIAL INSTRUMENTATION**

**Pressure Measurement**

Basics of pressure measurement: units of pressure and its conversions, different types of  
pressure,

manometers: errors in manometers, Bourdon gauges, Bellows, Diaphragms, Capsules, Dead  
weight tester.

Vacuum gauges- McLeod gauge, Pirani gauge, ionization gauge

**Level Measurement**

direct level measurement method-float type level indicator method ,Displacer and torque tube  
type level indicator,

indirect level measurement method-air purge type level indicator, capacitive level indicator,  
conductive level indicator, ultrasonic level gauge, radiation absorption method, laser method,

level transmitter- Differential Pressure type. measurement using strain gauges, capacitance type level indicator, level switch,

### **Temperature Measurement**

Different temperature scales and conversions - bimetallic thermometer , Mercury in glass thermometer, Mercury in steel thermometer, Gas and vapour pressure thermometer - Construction and working of radiation pyrometer, Optical pyrometer

Thermistors and its types. RTD-PTC & NTC, different types, Thermocouple & Types, properties, seebeck effect, Thomson effect, Peltier effect.

### **Flow Measurement**

Laminar and Turbulent flow, Reinold's number, Continuity equation, Bernoulli's theorem, Variable Head type flow meters, Variable area flow meters, Differential pressure flow transmitter, Electromagnetic flow meter, turbine flow meter, mass flow meter, ultrasonic flow meter, Hot wire anemometer, Positive displacement flow meters- Nutating disc type flow meters. Reciprocating piston type flow meters , oval gear type flow meters., Open channel flow meter.

Viscosity measurement: Kinematic and absolute viscosity, Saybolt and Redwood viscometer, Specific gravity measurement, speed measurement, humidity & moisture measurement, torque measurement, acceleration measurement.

## **MODULE 3 (12 marks)**

### **CONTROL SYSTEM**

Basics of Control System:

physical systems, physical model and mathematical model. linear time invariant and linear time variant system , open loop and closed loop controls system

Transfer Function:

Transfer function , Order of system. mechanical translational and rotational system. transfer functions of linear systems. poles and Zeros of Transfer function. analogous systems. Force/Torque – voltage and Force/Torque– current analogy.

Block Diagram and Signal Flow Graph:

Block Diagram algebra block diagram reduction rules. signal flow graph. Mason's gain formula.

Time Response Analysis:

Transient response and Steady state response. standard test signals transient response specifications of a system , characteristic equation, damping ratio, natural frequency and critical damping , Steady state error and Error Constants. Type of a system , Static error coefficients - Static position, velocity & acceleration error constants , steady state error.

Stability Analysis

Absolute Stability and Relative stability , Routh Hurwitz criterion , Root Locus technique ,Bode plot.

#### **MODULE 4 (15 marks)**

##### **PROCESS CONTROL**

###### *Concept of process Control*

block diagram of process control - Error, set point, controlled variable, manipulated variable, and Measured variable, Process characteristics, process parameters,Control modes, Pneumatic controllers, Controller tuning methods.

###### *Final Control Elements*

Pneumatic,hydraulic and electric actuators, Control valves- air to open and air to close, Valve plugs, valve characteristics, control valve coefficient Cv, Rangeability and Turn down, cavitation and flashing, control valve sizing.

auxiliary units of Control Valves- valve positioner, motion transmitter, booster relay, limit switch, air pressure regulator & I/P converter

###### **Process Control Strategies**

single variable process control ,independent variable process control , interactive variable process control ,compound variable process control ,multivariable process control , Feedback control system Feed forward control system , Cascade control system ,Ratio control system , Adaptive control system Split Range Control system .

###### **Computer in Process Control**

Data Loggers,Data Acquisition System , Supervisory control , Direct Digital Control , Centralized Computer control , Distributed Control system , PLC,SCADA,Basics of MATLAB SIMULINK, LabView

Applications of Operational Amplifiers in Process Control, basic Op Amp circuits.

###### **MODERN CONTROL STRATEGIES**

Intelligent Control,Artificial Neural network, Virtual Instrumentation, Fuzzy logic system,

Fundamentals of Robotics and Automation

P&I DIAGRAM, Process Flow Diagrams-graphical elements ,line symbols and Instrument Identification- codes, tags.

Digital Communication Channels-Field bus, Profibus and HART communication system.

#### **MODULE 5 (5 marks)**

##### **TELEMETRY**

General Telemetry system with block Diagram, Charecteristics,Voltage Telemetry System , Current Telemetry System , motion balance and Force balance current telemetry systems ,Position Telemetry System,

**MODULE 6 (10 marks)**

**ANALYTICAL INSTRUMENTATION**

**BASICS OF ANALYSIS AND ABSORPTION SPECTROMETERS:** Electromagnetic spectrum, absorption and emission, photometry, photometers, absorption spectrophotometers and infrared spectrophotometers,

Emission spectrophotometers- flame photometers, mass spectrometer, magnetic deflection mass spectrometer, time of flight mass spectrometer, NMR spectrometer, Raman Effect spectro photometer.

Chromatography : Classification of chromatography, gas chromatograph, liquid chromatograph, paper chromatograph

pH measurement and control : pH and pH scale, Buffer solution, Hydrogen electrode, glass electrode, sources of errors in glass electrode, methods of error compensation in glass electrode, calomel electrode, combined pH electrode, industrial electrode assembly dip and flow type

Industrial Analysers : Thermal conductivity analyzer, Thermal conductivity gas analyzer, magnetic force type and wind type Paramagnetic oxygen analyzers, Zirconia oxygen analyzer, Infrared analyzers, positive and negative filter type IR analyzer, Electrical conductivity analyzer, Electrical conductivity analyzer.

**MODULE 7 (8 marks)**

**BIOMEDICAL INSTRUMENTATION**

Resting and action potential of cell, physiological transducers-blood pressure measurement, blood flow meters, different physiological transducers.

ECG,EMG,EEG measurements, Electrode placement systems, different types of electrodes used for ECG, EEG and EMG measurement

Pacemakers, Defibrillators, Haemodialyser, Respirators, Ventilators, Blood cell counter,

IMAGING SYSTEMS: X-Ray, CAT scanning, Ultrasound scanning, MRI

Physiological effect of electricity on human body.

**MODULE 8 (5 marks)**

**OPTICAL INSTRUMENTATION**

Light and its properties, Interference, Newton's rings, Polarisation,Analyser.

Fibre Optic Communication : Optical Fiber Construction, modes of operation, Acceptance angle, Numerical Aperture, Losses in fiber optic cable.

Fiber Optic Sensors: Displacement, Flow, pressure, temperature, Strain, Torque and Fluid level sensors.

Opto electronic Components: photo diode, Photo Transistor, PiN Diode, Avalanche Photo Diode, LED and LED drive circuit.

#### LASER FUNDAMENTALS

Characteristics of laser, production of laser, Classification

Different types of laser

Applications of laser in different fields.

### **MODULE 9 (8 marks)**

#### **MEASUREMENT AND INSTRUMENTATION**

Performance characteristics of instruments, Errors in measurement, Moving coil and Moving iron instruments, D'Arsonval Galvanometer, Torques in moving System. conversion of galvanometer into voltmeter and ammeter. Multimeters, AC & DC bridges, Energy meter, Wattmeters. Recorders. oscilloscopes, Lissajous patterns.

Fundamentals of Gyro instruments.

### **MODULE 10 (7 marks)**

Power Devices- Basics of SCR, TRIAC, DIAC, Triggering and commutation,

AC and DC drives- Dual converters, Choppers

Transistors pnp and npn, Amplifier fundamentals, Transistor amplifiers, Oscillators, Types of feed back in amplifiers and oscillators,

Waveshaping circuits- Clipping & Clamping circuits, RC integrator & Differentiator. Multivibrators- Triggering methods.

Microcontroller: Architecture of 8051 microcontroller, pin details, Memory structure, Registers etc. Addressing modes, Instruction set.

Digital Electronics: Number system, Boolean algebra, logic gates, Demorgan's theorem, Flip Flops.

***NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper***